

1 Claims:

2 1. A method of forming a metal product, comprising the steps of: providing a metal alloy  
3 workpiece substrate have pre-process dimensions; determining dimensional differences  
4 between the pre-process dimensions of the workpiece substrate and desired post-process  
5 dimensions of a post-process metal product formed from the workpiece substrate;  
6 determining a build-up thickness of coating material required to obtain the desired post-  
7 process dimensions of the post-process metal product; performing a high-density coating  
8 process to coat the workpiece substrate with a coating material to build-up a thickness of  
9 coating material effective to obtain desired finished dimensions after performing a  
10 sintering heat treatment process and a hot isostatic pressing treatment; performing the  
11 sintering heat treatment on the coated workpiece substrate to densify the coating material;  
12 and then performing the hot isostatic pressing treatment to obtain the post-process metal  
13 product having the desired post-process dimensions and having diffusion bonding  
14 between the coating material and the workpiece substrate.

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16 2) A method of forming a metal product according to claim 1; wherein the metal alloy  
17 workpiece substrate comprises a nickel or cobalt-base superalloy; and the step of  
18 performing the high-density coating process comprises performing a high-density coating  
19 process such as a hyper velocity oxy-fuel thermal spray process or a detonation gun

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1 process to apply a high-density coating having the same nickel or cobalt-base superalloy  
2 composition as the metal alloy workpiece substrate.

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4 3) A method of forming a metal product according to claim 2; wherein the step of  
5 performing the sintering heat treatment comprises sintering at a temperature at or about  
6 1825 to 2150 degrees F for about 1/2 to 2 hours.

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8 4) A method of forming a metal product according to claim 2; wherein the step of  
9 performing the hot isostatic pressing treatment comprises hot isostatic pressing at a  
10 temperature of about 2200F in about 15 KSI argon for about 4 hours.

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12 5) A method of forming a metal product according to claim 1; wherein the step of hot  
13 isostatic pressing treatment comprises the step of heating the coated workpiece substrate  
14 to a temperature that is substantially 80% of the melting point of the metal alloy; and  
15 pressurizing the coated workpiece substrate to a pressure substantially between 20 and 50  
16 percent of the yield strength of the metal alloy in an inert gas atmosphere.

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1 13) A method of forming a metal product according to claim 9; further comprising the  
2 step of performing a sintering heat treatment on the coated workpiece substrate to densify  
3 the coating material before performing the hot isostatic pressing treatment.

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5 14) A method of forming a metal product according to claim 13; wherein the step of  
6 performing the sintering heat treatment comprises sintering at a temperature at or about  
7 1825 to 2150 degrees F for about 1/2 to 2 hours.

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9 15) A method of forming a metal product according to claim 9; wherein the workpiece  
10 substrate comprises a nickel or cobalt-base superalloy; and the step of performing the  
11 high-density coating process comprises performing a high-density coating process such  
12 as a hyper velocity oxy-fuel thermal spray process or a detonation gun process to apply a  
13 high-density coating having the same nickel or cobalt-base superalloy composition as the  
14 workpiece substrate.

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16 16) A method of forming a metal product according to claim 9; wherein the coating  
17 material built-up during the high-density coating process is comprised of a same metal  
18 alloy as the workpiece substrate.

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- 1 20) A method of forming a metal product according to claim 19; further comprising the
- 2 step of performing a sintering heat treatment on the coated workpiece substrate to densify
- 3 the coating material before performing the hot isostatic pressing treatment.

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